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EXAMINER

BROCK II, PAUL E

ART UNIT

PAPER NUMBER

2815

DATE MAILED: 02/25/2003

Please find below and/or attached an Office communication concerning this application or proceeding.

# Office Action Summary

Application No.

09/648,111

Applicant(s)

HWANG, KWANG-JO

Examiner

Paul E Brock II

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-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

## Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133).
- Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

## Status

- 1) ☒ Responsive to communication(s) filed on 02 December 2002.
- 2a) ☐ This action is **FINAL**. 2b) ☒ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

## Disposition of Claims

- 4) ☒ Claim(s) 1-11 and 13-31 is/are pending in the application.
- 4a) Of the above claim(s) \_\_\_\_\_ is/are withdrawn from consideration.
- 5) ☐ Claim(s) \_\_\_\_\_ is/are allowed.
- 6) ☒ Claim(s) 1-11 and 13-31 is/are rejected.
- 7) ☐ Claim(s) \_\_\_\_\_ is/are objected to.
- 8) ☐ Claim(s) \_\_\_\_\_ are subject to restriction and/or election requirement.

## Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☒ The drawing(s) filed on 25 August 2000 is/are: a) ☒ accepted or b) ☐ objected to by the Examiner.
- Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
- 11) ☐ The proposed drawing correction filed on \_\_\_\_\_ is: a) ☐ approved b) ☐ disapproved by the Examiner.
- If approved, corrected drawings are required in reply to this Office action.
- 12) ☐ The oath or declaration is objected to by the Examiner.

## Priority under 35 U.S.C. §§ 119 and 120

- 13) ☒ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☒ All b) ☐ Some \* c) ☐ None of:
1. ☒ Certified copies of the priority documents have been received.
2. ☐ Certified copies of the priority documents have been received in Application No. \_\_\_\_\_.
3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).
- \* See the attached detailed Office action for a list of the certified copies not received.
- 14) ☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. § 119(e) (to a provisional application).
- a) ☐ The translation of the foreign language provisional application has been received.
- 15) ☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. §§ 120 and/or 121.

## Attachment(s)

- 1) ☐ Notice of References Cited (PTO-892)
- 2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
- 3) ☐ Information Disclosure Statement(s) (PTO-1449) Paper No(s) \_\_\_\_\_
- 4) ☐ Interview Summary (PTO-413) Paper No(s). \_\_\_\_\_
- 5) ☐ Notice of Informal Patent Application (PTO-152)
- 6) ☐ Other: \_\_\_\_\_

## DETAILED ACTION

### *Claim Rejections - 35 USC § 103*

1. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

2. Claims 1, 2, 5 – 9, 11, 13, 15, 16, 20 – 22, 24 and 28 – 31 are rejected under 35

U.S.C. 103(a) as being unpatentable over Hirano et al. (USPAT 5771110, Hirano) in view of Chen (USPAT 6133145).

Hirano discloses in figures 1 – 16 a method of manufacturing a liquid crystal display device.

With regard to claim 1, Hirano discloses in figures 1 – 8 forming a switching element (2 – 7) on a substrate (1). Hirano discloses in figure 13 forming a passivation layer (14) over the substrate. Hirano discloses in figure 14 depositing a metal layer (16) on the passivation layer. Hirano discloses in column 12, lines 54 – 60 forming a photoresist pattern on the metal layer, such that a portion of the metal layer is exposed. Hirano discloses in figure 15 and column 12, lines 54 – 60 etching a portion of the metal layer to form a pixel electrode. Hirano does not teach treating the exposed portion of the metal layer with a first plasma, prior to etching. Chen teaches in figures 5 and 6 and column 4, lines 16 – 24 treating an exposed portion of a metal layer (10a) with a first plasma (a plasma treatment in a nitrogen ambient, col. 4, lines 20 – 24), prior to any step of etching a photoresist pattern (12b), and prior to any step of etching the metal layer, using the photoresist as a mask, to lower a binding force in the exposed portion. It would

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have been obvious to one of ordinary skill in the art at the time of the present invention to use the treating method of Chen in the method of Hirano in order to form a resilient layer on the surface of the resist pattern.

With regard to claim 2, Hirano discloses in column 11, line 63 wherein the switching element is a thin film transistor.

With regard to claim 5, Chen teaches in figure 5 and column 4, lines 16 – 24 using a non-reactive gas to lower a binding force in the exposed portion.

With regard to claim 6, Chen discloses in figure 5 and column 4, lines 16 – 24 wherein the non-reactive gas includes N<sub>2</sub>.

With regard to claim 7, Hirano discloses in column 12, lines 54 – 60 the step of etching the metal layer involves a dry-etching technique.

With regard to claim 8, Hirano discloses in column 12, lines 54 – 60 the step of etching the metal layer includes etching the metal layer with HBr plasma gas.

With regard to claim 9, Hirano discloses in column 12, lines 54 – 60 the step of etching the metal layer includes etching the metal layer with a composition of HBr plasma gas and Cl<sub>2</sub> plasma gas.

With regard to claim 11, Hirano discloses in column 12, lines 48 – 60 the metal layer is indium tin oxide (ITO).

With regard to claim 30, Hirano discloses in figure 14 depositing a metal layer (16) on a passivation layer (14) which partially covers a transistor (2 – 7). Hirano discloses in column 12, lines 48 – 60 forming a photoresist pattern on the metal layer, leaving a portion of the metal layer uncovered. Hirano discloses in column 12, lines 57 – 60 etching the uncovered portion of the

metal layer with a second plasma to form a pixel electrode. Hirano does not teach exposing the uncovered portion of the metal layer to a first plasma, prior to etching. Chen teaches in figure 5 and column 4, lines 16 – 24 exposing an uncovered portion of a metal layer (10a) to at least one first gas (a plasma treatment in a nitrogen ambient, col. 4, lines 20 – 24), prior to any step of etching a photoresist pattern (12b) and prior to any step of etching the metal layer to lower a binding force in the uncovered portion. It would have been obvious to one of ordinary skill in the art at the time of the present invention to use the exposing method of Chen in the method of Hirano in order to form a resilient layer on the surface of the resist pattern.

With regard to claim 13, Chen discloses in figure 5 and column 4, lines 16 – 24 wherein the first gas is a reactive gas.

With regard to claim 15, Chen teaches in figure 5 and column 4, lines 16 – 24 wherein the first gas is a non-reactive gas.

With regard to claim 16, Chen discloses in figure 5 and column 4, lines 16 – 24 wherein the non-reactive gas includes N<sub>2</sub>.

With regard to claim 20, Hirano discloses in column 12, lines 48 – 60 wherein the metal layer is indium tin oxide (ITO).

With regard to claim 21, Hirano discloses in figure 15 removing the photoresist pattern from the pixel electrode.

With regard to claim 22, Hirano discloses in figure 14, depositing a metal layer (16) over a substrate (1). Hirano discloses in column 12, lines 54 – 60 forming a mask on the metal layer, leaving a portion of the metal layer uncovered. Hirano discloses in column 12, lines 57 – 60 etching the uncovered portion of the metal layer with a second plasma to form a metal pattern.

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Hirano does not teach exposing the uncovered portion of the metal layer to a first plasma, prior to etching. Chen teaches in figure 5 and column 4, lines 13 – 24 exposing an uncovered portion of a metal layer (10a) to a first plasma (a plasma treatment in a nitrogen ambient, col. 4, lines 20 – 24), prior to any step of etching a mask (12b), and prior to any step of etching the metal layer, to lower a binding force in the uncovered portion. It would have been obvious to one of ordinary skill in the art at the time of the present invention to use the exposing method of Chen in the method of Hirano in order to form a resilient layer on the surface of the resist pattern.

With regard to claim 24, Chen teaches in figure 5 and column 4, lines 13 – 24 wherein the first plasma includes N<sub>2</sub>.

With regard to claim 28, Hirano discloses in column 12, lines 48 – 60 the metal layer is indium tin oxide (ITO).

With regard to claim 29, Hirano discloses in figure 15 that the metal pattern includes a pixel electrode of a display device.

With regard to claim 31, Hirano discloses in figure 14 depositing a metal layer (16) on a passivation layer (14) which partially covers a transistor (2 – 7). Hirano discloses in column 12, lines 48 – 60 forming a photoresist pattern adjacent to the metal layer, leaving a portion of the metal layer uncovered. Hirano discloses in column 12, lines 57 – 60 etching the uncovered portion of the metal layer with a second plasma to form a pixel electrode. Hirano does not teach exposing the uncovered portion of the metal layer to a first plasma, prior to etching. Chen teaches in figure 5 and column 4, lines 16 – 24 exposing an exposed portion of a metal layer (10a) to at least one first gas (a plasma treatment in a nitrogen ambient, col. 4, lines 20 – 24), prior to any step of etching, to lower a binding force in the uncovered portion. It would have

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been obvious to one of ordinary skill in the art at the time of the present invention to use the exposing method of Chen in the method of Hirano in order to form a resilient layer on the surface of the resist pattern.

3. Claims 10, 17 – 19, and 25 – 27 are rejected under 35 U.S.C. 103(a) as being unpatentable over Hirano and Chen as applied to claims 1, 7, 22 and 30 respectively, above, and further in view of Ye et al. (USPAT 5968847, Ye).

With regard to claim 10, Hirano and Chen do not disclose the combination of HBr and CH<sub>4</sub> as plasma gasses. Ye teaches in column 12, lines 55 – 62 that a composition of HBr and CH<sub>4</sub> can be used for etching a metal layer. It would have been obvious to one of ordinary skill in the art at the time of the present invention to use the composition of HBr and CH<sub>4</sub> for etching a metal layer because both are well known etching gasses that are readily available in a production fabrication facility.

With regard to claims 17 and 18, Hirano discloses at least one second gas that includes Cl<sub>2</sub>. Hirano and Chen do not disclose that the at least one second gas includes an HBr plasma gas. Ye teaches in column 5, lines 15 – 20 at least one second gas that includes an HBr plasma gas. It would have been obvious to one of ordinary skill in the art at the time of the present invention to use the HBr plasma gas of Ye as an additional gas with Cl<sub>2</sub> in the second etch step of Hirano and Chen for etching a metal layer in order to enhance the etching properties of the plasma by creating a more diverse reactive plasma gas.

With regard to claims 25 and 26, Hirano discloses a second plasma gas that includes Cl<sub>2</sub>. Hirano and Chen do not disclose that the second plasma gas includes an HBr plasma gas. Ye

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teaches in column 5, lines 15 – 20 a plasma that includes both HBr and Cl<sub>2</sub> for removing a metal layer. It would have been obvious to one of ordinary skill in the art at the time of the present invention to use the HBr plasma gas of Ye as an additional gas with Cl<sub>2</sub> in the second etch step of Hirano and Chen for etching a metal layer in order to enhance the etching properties of the plasma by creating a more diverse reactive plasma gas.

With regard to claim 19, Hirano discloses at least one second gas that includes Cl<sub>2</sub>. Hirano and Chen do not teach the use of HBr and CH<sub>4</sub> as etching gasses. Ye discloses in column 5, lines 15 – 20 the use of HBr and CH<sub>4</sub> in the same metal etch step that just Cl<sub>2</sub> is used. It would have been obvious to one of ordinary skill in the art at the time of the present invention to use the combination of HBr and CH<sub>4</sub> of Ye as a substitute gas for Cl<sub>2</sub> of Hirano and Chen in the second etching step in order to enhance the etching properties of the plasma by creating a more diverse reactive plasma gas.

With regard to claim 27, Hirano discloses the use of Cl<sub>2</sub> for the second etching step. Hirano and Chen do not teach the use of HBr and CH<sub>4</sub> as etching gasses. Ye discloses in column 5, lines 15 – 20 the use of HBr and CH<sub>4</sub> in the same metal etch step that just Cl<sub>2</sub> is used in. It would have been obvious to one of ordinary skill in the art at the time of the present invention to use the combination of HBr and CH<sub>4</sub> of Ye as a substitute gas for Cl<sub>2</sub> of Hirano and Chen in the second etching step in order to enhance the etching properties of the plasma by creating a more diverse reactive plasma gas.

4. Claims 3, 4, 14, and 23 are rejected under 35 U.S.C. 103(a) as being unpatentable over Hirano and Chen as applied to claims 1, 13, 22 and 30, respectively, above, and further in view of Muraguchi et al. (JPPAT 361002368, Muraguchi).

With regard to claim 3, Hirano and Chen do not teach the step of treating the exposed portion of the metal layers includes using a reactive gas. Muraguchi teaches in the Constitution using a reactive gas in a step of treating an exposed portion of a metal layer to lower a binding force in the exposed portion. It would have been obvious to one of ordinary skill in the art at the time of the present invention to use the reactive gas of Muraguchi in the method of Hirano and Chen in order to reduce oxygen atoms without resulting in crystal damage to the surface.

With regard to claims 4 and 14, Muraguchi discloses that the reactive gas is H<sub>2</sub>.

With regard to claim 23, for the same reasons as stated above with regard to claims 3, 4 and 14 it would have been obvious to use the H<sub>2</sub> plasma gas of Mohri in the first plasma of Hirano.

### ***Response to Arguments***

5. Applicant's arguments filed December 2, 2002 have been fully considered but they are not persuasive.

6. With regard to the applicant's arguments that the proposed combination does not "discloses or suggests a combination of elements... including treating the exposed portion of the metal layer with a first plasma, prior to any step of etching said photoresist pattern as a mask, to lower a binding force in the exposed portions [of the metal layer]," it should be noted in figure 5

of Chen that prior to any step of etching a photoresist mask 12b or a metal layer 10a Chen teaches in column 4, lines 13 – 24 exposing an uncovered portion of the metal layer (10a) to a first plasma (a plasma treatment in a nitrogen ambient, col. 4, lines 20 – 24). Chen teaches in figure 5 and column 4, lines 13 – 24 that the treatment step occurs in the step directly after the formation of photoresist mask 12b and before the metal etch step of metal 10a. Therefore, before any step of etching the mask 12b and the metal 10a, a treating step is performed. Hirano in combination with this step provides sufficient support for the rejection of the claimed invention. Therefore, the arguments are not persuasive, and the rejection is proper.

7. Further, it should be noted that Hirano discloses in figures 14 – 15 and column 12, lines 54 – 60 etching metal layer 16 using a photoresist mask deposited directly thereon. There is no disclosure, teaching or suggestion in Hirano that any etching step is performed on this photoresist mask before the metal etch. Chen clearly teaches in figure 5 and column 4, lines 13 – 24 a treating step before any etching is performed on an exposed metal layer 10a and the photoresist mask 12b thereon. There is no disclosure, teaching or suggestion in Hirano that any etching step is performed on this photoresist mask (12b) before the metal etch. The only possible combination of Hirano with Chen would yield a treating step directly before the metal etch while the photoresist mask is present and the metal layer is exposed. Therefore, the arguments are not persuasive, and the rejection is proper.

8. It should be noted that Chen does teach a first step of etching a photoresist pattern 12a prior to the metal etch step. However, this first etching step defines the photoresist pattern 12b

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from photoresist pattern 12a such that 12b is the photoresist pattern remaining after this first step of etching is completed. Photoresist pattern 12a, and the etching thereof, is not used in the rejections. Therefore, "any step of etching" photoresist pattern 12b does not include steps used in etching photoresist pattern 12a. Also, photoresist pattern 12b is used for defining a metal etch step, while this first step of etching photoresist pattern 12a is not a metal etch step. Thus, no etching is performed on photoresist pattern 12b before the metal etch step. Therefore, the arguments are not persuasive, and the rejection is proper.


### *Conclusion*

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Paul E Brock II whose telephone number is (703)308-6236. The examiner can normally be reached on 8:30 AM-5:30 PM.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Eddie Lee can be reached on (703)308-1690. The fax phone numbers for the organization where this application or proceeding is assigned are (703)308-7722 for regular communications and (703)308-7722 for After Final communications.

Any inquiry of a general nature or relating to the status of this application or proceeding should be directed to the receptionist whose telephone number is (703)308-0956.

Paul E Brock II  
February 20, 2003



**EDDIE LEE**  
**SUPERVISORY PATENT EXAMINER**  
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